

Operate any motor vehicle
more efficiently with a

MARK TEN



A wholly new

**CAPACITIVE
DISCHARGE**

IGNITION SYSTEM

for all
**CARS
BOATS
TRUCKS**

The true electronic solution to one of the major problems of engine operation! The Mark Ten, using SCR (Silicon Controlled Rectifier) Switching, provides brand new levels of engine performance and economy.

Produced for more than six years as a proven system, the Mark Ten is unaffected by extremes of temperature and operating conditions. It installs quickly and easily without rewiring and is available for 6 or 12 volt negative or positive ground systems.

Compare these proven benefits:

- ▲ Up to 20% Increase in Gasoline Mileage
- ▲ Installs in Only 10 Minutes on any Car or Boat
- ▲ Spark Plugs Last 3 to 10 Times Longer
- ▲ Instant Starts in all Weather
- ▲ Dramatic Increase in Acceleration and General Performance
- ▲ Promotes More Complete Combustion
- ▲ Virtually Eliminates Ignition Tune-Ups



DELTA PRODUCTS, INC.

P.O. Box 1147 / Grand Junction, Colo. 81501
Area Code 303 Phone 242-9000

MARK TEN — A New Ignition System for All Motor Vehicles

The Mark Ten is a carefully engineered, electronic ignition system which incorporates the acknowledged advantages of capacitive discharge with those of solid state electronics. The Mark Ten is the *original* SCR (silicon controlled rectifier) capacitive discharge system, the *first* of its type in volume production, and it is now the *largest* selling unit of its type on the market. It is capable of providing substantial improvements in your engine performance, superior to the best available magneto systems. The Mark Ten overcomes the inherent disadvantages of both standard and transistorized ignition systems.

Increased Energy

In operation, the Mark Ten provides energy many times that of conventional systems, thus assuring a more complete combustion process. This gives a definite increase in your gasoline mileage as well as readily apparent increases in acceleration and general engine performance for your car, truck or boat. The fact that the combustion process is more complete materially reduces the formation of residuals and other contaminants which shorten the life of your engine.

Uses Electronic Switching

The Mark Ten incorporates unique and patented circuitry which overcomes the mechanical limitations of the Kettering system. By using electronic switching and triggering, problems of "point bounce" and multiple firing are eliminated, and the points, which are now used only as a reference, will last the life of the rubbing block. In addition, the physical condition and the presence of contaminants on the points will not impair the operation of the Mark Ten, nor is it as sensitive to variations in point gap and dwell as are standard and transistorized systems.

Unlike conventional and transistorized ignition systems, the Mark Ten uses minimal current (1 amp.) under idle conditions, and its requirements are not increased until the engine is placed under load condition. Being a demand type system, fulfilling only the requirements of the combustion process, the Mark Ten is not adversely affected if one or more of the spark plug wires are removed while the engine is in operation.

Longer Spark Plug Life

Spark plug life is materially improved by this unit, and plugs should last from 3 to 10 times longer. Although it is true that the Mark Ten generates 3 to 4 times more energy than the standard system, the electrode erosion rate is basically determined by the duration of the spark, which is approximately 1/10 that of the standard system. This fast rise time spark

eliminates fouling and will actually clean dirty plugs in short order, after the Mark Ten has been installed. In addition, the spark magnitude insures proper ignition of the fuel under *all* operating conditions, which dramatically improves the starting and general performance of the engine.

Proven Performance

Field reports prove that gasoline mileage is increased 10-20%, and that ignition maintenance is reduced from 60-80%. All users report substantial increases in acceleration, and improved engine performance. Cold weather starting is dramatically improved, with users reporting no starting difficulty at extremes of -40° F. This would also be true in more temperate climates when your battery condition is quite marginal and your vehicle is either difficult to start or is susceptible to flooding.

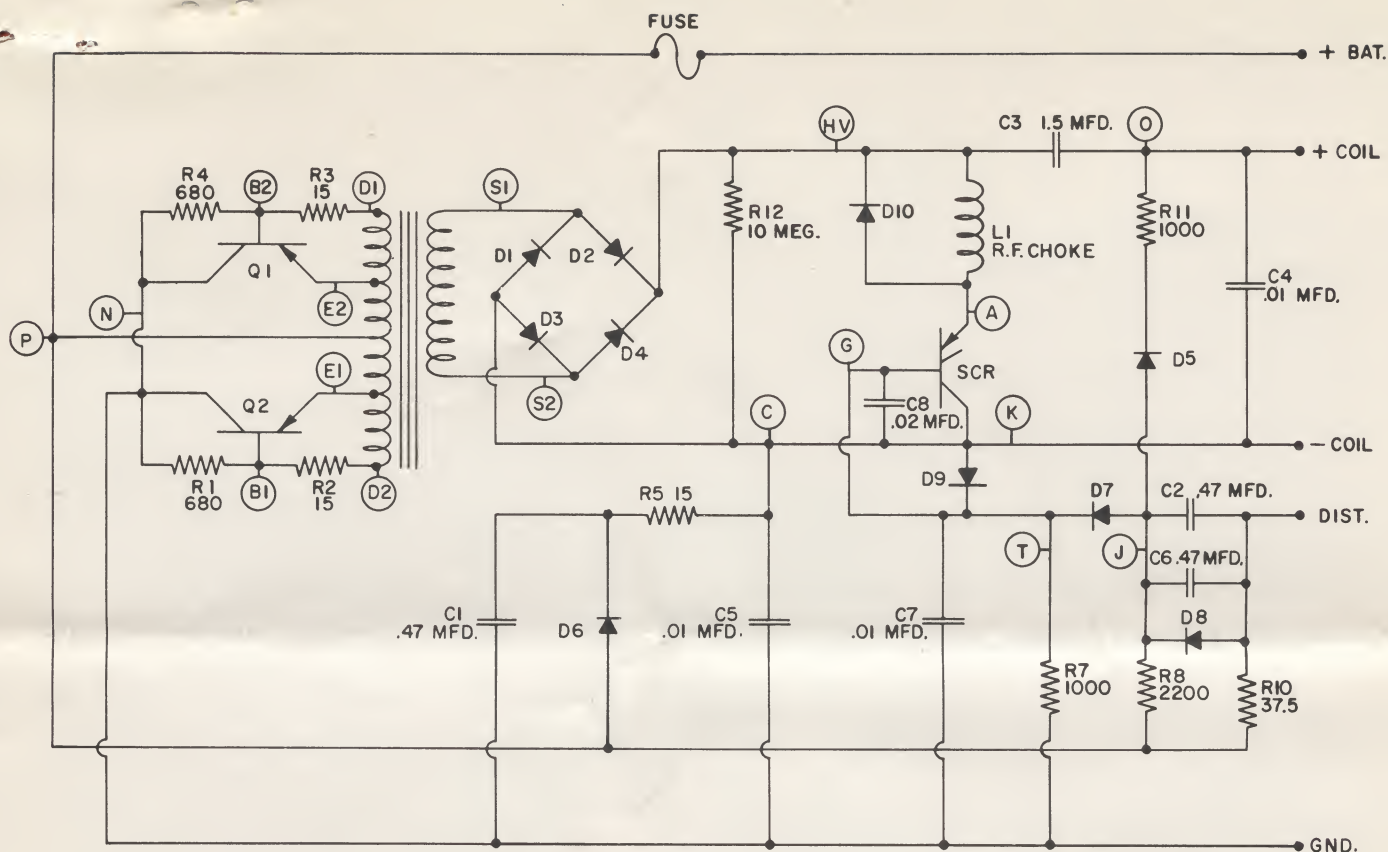
In the field the Mark Ten has proven to be an extremely reliable unit. It will give many years of trouble-free service while operating under the most adverse of conditions. Each component is carefully selected and tested prior to assembly, and each completed unit is functionally tested at motor speeds in excess of 10,000 RPM, to insure accurate ignition control and proper operation. The unit is not affected by extremes of temperature, altitude or humidity, and it is safely and conservatively warranted for three years.

Mark Ten Has Many Applications

The Mark Ten is available in either 6 volt or 12 volt, positive or negative ground models — which are *not* interchangeable — and may be used on any engine having a battery generator or alternator system. It is currently used on military, farm, municipal, commercial and private automobiles, trucks, marine engines, motorcycles, warehouse loading equipment, and stationary engines. It is extremely adaptable to sports cars, competition cars and boats. One *Caution*: You *must* specify voltage and polarity or vehicle make and model when ordering. All vehicles having the *same* voltage and *same* polarity use the same unit, allowing you to transfer the Mark Ten from one vehicle to another.

Works With Tachometers

The Mark Ten system has been designed to work with virtually all of the tachometers on the market, and each unit contains instructions for properly connecting your tachometer. The Mark Ten is a superior electronic product, sensibly priced, and will outperform any other known ignition system on the market, regardless of price!



Circuit Operation

The system consists of a d-c to d-c converter (to change the battery voltage to a higher voltage for storage), a storage element (capacitor), a switching element (silicon controlled rectifier), and a high-voltage output transformer (coil) to transform the low-voltage stored d-c to a level that will fire the spark plugs.

The applied battery voltage is converted from a nominal 12 volts to approximately 400 volts by the converter circuitry (transistors Q1, Q2, and transformer T1). This converter operates as follows; the battery voltage applied to transformer T1 causes current to flow through resistors R1, R2, R3, and R4. Since it is impossible for these two paths to be equal in resistance, one half of the primary winding will have a higher current flow.

Assuming that the upper half of the primary winding carries slightly higher current than the lower, the voltages developed in the two feedback windings (the ends connected to R3 and R2) tend to turn Q2 and Q1 off. This increases the current through the upper half of the transformer winding. The increase in current further drives Q2 into conduction and Q1 into cutoff, simultaneously transferring energy to the secondary of T1.

When the current through the upper half of the primary of T1 reaches a point where it can no longer increase, due to resistance in the primary circuit and/or transformer core saturation, the signal applied to the transistor from the feedback winding drops to zero, turning Q2 off. The current in this winding immediately starts decreasing, causing a collapse of the magnetic field. This collapsing field, cutting across all the windings in the transformer, develops voltages in the transformer opposite in polarity to the voltage developed by the expanding field. This voltage now drives Q2 into cutoff and Q1 into conduction and simultaneously delivers power to the diode bridge. Once started, this action converts the applied battery voltage into an alternating signal.

The voltage applied to the diode bridge is rectified to a d-c potential of about 400 volts, charging capacitor C3, through the coil, connected through the minus and plus coil terminals to the negative terminal of the diode bridge. This action takes place as soon as power is applied by turning on the ignition key. Simultaneously, battery voltage is applied to the point circuit through resistor R10, and to the SCR through diode D6 and resistor R5 with capacitor C1 serving as a filter to prevent false triggering caused by noise transients.

Assume that the points are closed and the ignition key is turned on. As the first cylinder comes up on compression and reaches the position where the spark plug should be fired, the points open. The current available at the junction of R10 and C2 now flows through C2 and D7 to the silicon controlled rectifier. This current switches the SCR on.

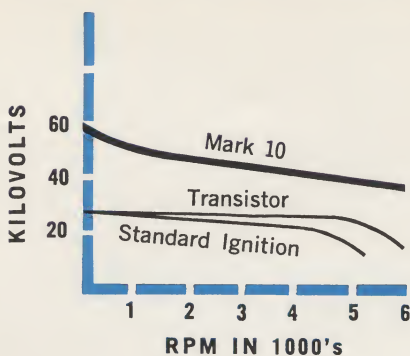
When the SCR turns on two things happen simultaneously. The silicon controlled rectifier short circuits the power supply with the effect of the short reflected to the primary of T1 which removes the drive from transistors Q1 and Q2 stopping converter operation. The SCR also connects the positive side of C3 to the lower coil connection. This forms a closed circuit consisting of the capacitor, silicon controlled rectifier, and coil primary. The energy stored in the capacitor is now delivered to the ignition coil. The coil primary voltage rises from zero to 400 volts in approximately two microseconds.

In the circuit made up of the silicon controlled rectifier, capacitor, and coil, a resonant circuit is formed between the primary coil inductance and capacitor C3. The flywheel effect of this circuit restores unused energy to the capacitor as follows; the capacitor discharge-current flows through the SCR and coil primary creating a magnetic field in the coil. This current continues to flow in the circuit until the capacitor is charged in a reverse direction to approximately 300 volts. At this point the current attempts to reverse through the SCR causing the SCR to return to its off condition. The reverse voltage now causes the diode bridge to conduct as a short circuit (all diodes simultaneously in a conduction mode) discharging the capacitor to zero from its reverse direction and recharging the capacitor towards its normal state. When the current supplied by the coil inductance again drops to zero, the bridge returns to a normal state, the load is removed from transformer T1 and normal converter operation resumes.

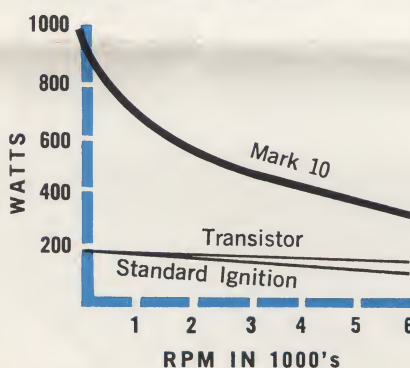
Diodes D5 and D8 in conjunction with R11 serve to discharge the triggering capacitor C2 completely when the SCR turns on. Diode D7 and resistor R8 prevent erratic triggering caused by point bounce. Resistor R7 is used to reverse bias the SCR to prevent erratic triggering due to noise. Diode D10 and RF choke L1 are used to control the turn on characteristics of the SCR.

MARK TEN PERFORMANCE CHARTS

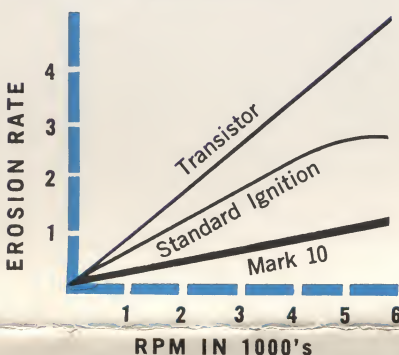
Open Circuit Output Voltage



Peak Impulse Power



Spark Plug Erosion



DELTA PRODUCTS, INC.

P.O. Box 1147 GPN • Grand Junction, Colo. 81501

Enclosed is \$_____. ☐ Ship ppd. ☐ Ship C.O.D.

Please send:

☐ **Mark Tens (Deltakit®) @ \$29.95**

(12 VOLT POSITIVE OR NEGATIVE GROUND ONLY)

☐ **Mark Tens (Assembled) @ \$44.95**

☐ 6 Volt: Negative Ground only.

☐ 12 Volt: Specify

☐ Positive Ground

☐ Negative Ground

Car Year _____ Make _____

Name _____

Address _____

City/State _____ Zip _____

Read what satisfied users say

"In the first race my Mark Ten equipped Sprite was so much stronger that I was able to lap my competitors. This had never happened before. I am still using the same plugs and have won the four races entered thus far by a very convincing margin. The last of those four was a National Championship race where I was up against some of the best from all the Western States..."

R. E.
Mechanical Engr., Zenith, Wn.

"Wow! My company owned 1964 Ford 6 is up about 10% in mileage and much better in performance. I am 200% satisfied with the Mark Ten."

H. L. H.
Sales Engineer
Prominent Oil Company

"...We had an enthusiastic young employee install the Mark Ten on his Pontiac "GTO". He confirms all the benefits you claim in your various pieces of literature. We are completely sold on this unit."

W. K. M.
Industrial Supply Company

"...There was certainly a dramatic improvement in the operation of the vehicle, mainly in low speed pickup and the miles per gallon increased by six..."

A. R. J.
Fleet Operator

"...Kit assembly proved to be surprisingly simple. The real shock came when I put it on the car. I've never had acceleration and performance like this before."

C. J.
Electronic Engineer
Prominent Aerospace Co.

"...With your Mark Ten, my truck worked beautifully through six weeks of sub-zero weather, down to 40 degrees below."

L. M.
Red Lake Falls, Minnesota

"For the past six months, with the Mark Ten installed, I have averaged 32-34 m.p.g. on my VW, which I consider excellent. In addition, top speed has been increased about 7-8 MPH and acceleration has been increased substantially. This is most noticeable when I am in the mountains and the car is heavily loaded. It turns the mountains into hills and the hills into flat country. Every salesman on the road should have one of these units on his car..."

J. L.
Traveling Salesman
Rocky Mountain Empire

"...it increased my mileage on my 1963 Rambler from 17.2 MPG to 21.6 MPG."

W. H.
Lansing, Illinois

"That Mark Ten Ignition System sure does the job. After some minor adjustments, the performance is quite unbelievable..."

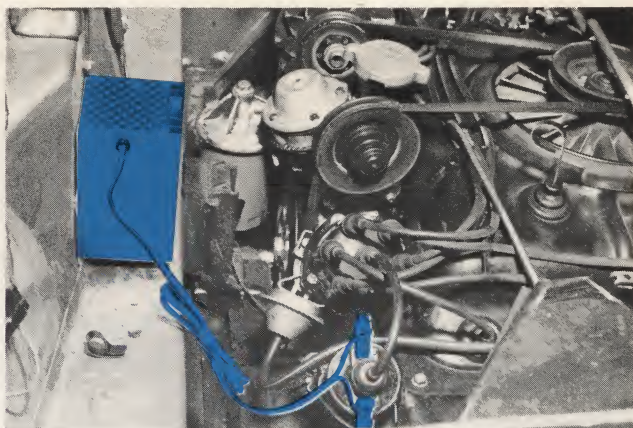
A. H. F.
Publication Executive

"Your Thunderbolt unit seems, so far, to do a remarkable job, and I appreciate your bringing it to my attention..."

H. P.
Prominent Aircraft Manufacturer

Easy Installation

The unit installs easily under the hood in less than ten minutes with two simple connections to the *existing* coil, leaving the standard system intact for easy comparison. No rewiring, no replacement or substitution of existing components is necessary. Standard coils should be retained, as special or high ratio coils impede proper operation. The system is designed to be used with standard radio resistance secondary wire (TVRS), so long as it is in good condition. The unit is *not* sensitive to extremes in temperature.



Installation above is typical for air-cooled Corvair engine. Actual installation time: 8¾ minutes. No heat problem.

Available in Factory Assembled Model or in **DELTAKIT**

*Assemble it
Yourself!*



ELECTRICAL SPECIFICATIONS

For typical 12 volt installation

Input Source: 12 volt positive or negative ground battery generator or alternator system.

Input Current: 1-5 amperes depending on engine RPM

Output Voltage: 400 volt discharge pulse

Triggering Source: Ignition points or suitable triggering source

Max. Point Series Resistance: Approximately 25 ohms

Min. Point Shunting Resistance: Approximately 200 ohms

Typical Open Circuit Secondary Voltage:

Cranking 8 volt input — 35 KV
500 RPM 12 volt input — 50 KV
7500 RPM 14 volt input — 40 KV

Application

ANY 6 or 12 volt, positive or negative ground gasoline, LPG or propane powered engine. Currently used on domestic automobiles, trucks, marine engines (inboard and outboard), motorcycles, warehouse loading equipment and stationary engines. **Extremely** adaptable to competition cars and boats.

When ordering, specify battery polarity and voltage or car make and year.

Delta's proven SCR MARK TEN® with end plates removed (see color photo above) is the ultimate in space age electronics applied to a proven SCR ignition system. It is produced in high volume from components available commercially and is sensibly priced for individual use and fleet application alike. Many like the enjoyment of constructing their own unit, so Delta provides the Mark Ten in kit form with complete instructions for assembly. Unlike some "mystery" ignition systems we've seen — potted so you can't see what is inside — the Mark Ten has no secrets, just superior design and engineering with a standard kit warranty on all parts.

ORDER TODAY!

Mark Ten (Assembled) \$44.95

Mark Ten (Deltakit) \$29.95

Kit available in 12 volt only, positive or negative ground.



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P.O. Box 1147 / Grand Junction, Colo. 81501
Area Code 303 Phone 242-9000

LITHO IN U.S.A.



New from DELTA

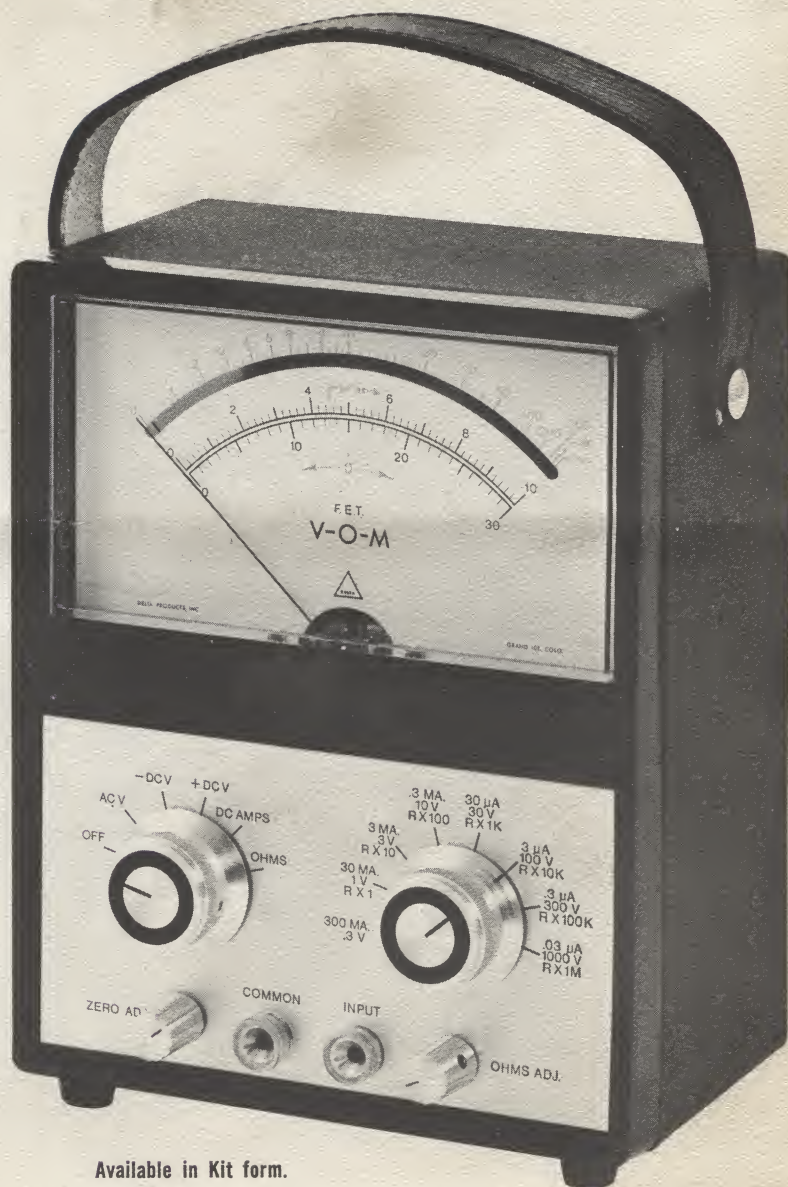
Model 3000 FET-VOM

A unique and efficient instrument bridging the gap between a multimeter and a digital voltmeter!

\$74⁹⁵
only ppd.

—Specifications—

ACCURACY.....	DC volts $\pm 2\%$ of full scale Nominal $\pm 1\%$ of full scale DC amperes $\pm 2\%$ of full scale Nominal $\pm 1\%$ of full scale AC volts (60 HZ) $\pm 3\%$ of full scale Nominal $\pm 2\%$ of full scale Ohms 10% to 90% of scale $\pm 5\%$ absolute
GENERAL.....	Input impedance, 10 meg ohms $\pm 1\%$ Size 6½ W x 8 H x 3½ D Wt. 3¾ lbs.
FREQUENCY RESPONSE.....	20 HZ to 20 KHZ $\pm 1\%$ on .3V scale 20 HZ to 100 HZ $\pm 1\%$ or better on all scales
RANGES AC-DC VOLTS.....	300 millivolts to 1000 volts full scale (Reads 10 millivolts to 1000 volts)
AMPERES.....	30 nano amperes to 300 milliamperes (Reads 1 nano ampere to 300 milliamperes)
OHMS.....	10 ohm center scale to 10 meg ohms center scale (Reads 0 to 1 billion ohms)



Available in Kit form.
Feedback network with pre-selected components to eliminate all calibration.

\$59⁹⁵
Only ppd.

Ready to use when assembled!

Check these Delta features:

1. Mirror scale D'Arsonval meter
2. Integrated circuit (IC) operational amplifier for extreme accuracy
3. FET input stage with current regulator
4. Two stage transistor current regulator and Zener diode on OHMS for absolute stability and accuracy
5. Voltage clippers for protection of input stage
6. Fully temperature compensated for low low zero drift
7. Ten turn ZERO and OHMS adjust potentiometers
8. Glass reinforced circuit boards and metal case
9. Enclosed switches
10. Uses readily available type AA cells
11. Uses standard test leads for maximum flexibility and ease of measurement
12. 10 Megohms input impedance

Model 3000 RANGES:

OHMS: RX1, X10, X100, X1K, X10K, X100K, X1Meg.

CURRENT: .03uA, .3uA, 3uA, 30uA, .3MA, 3MA, 30MA, 300MA.

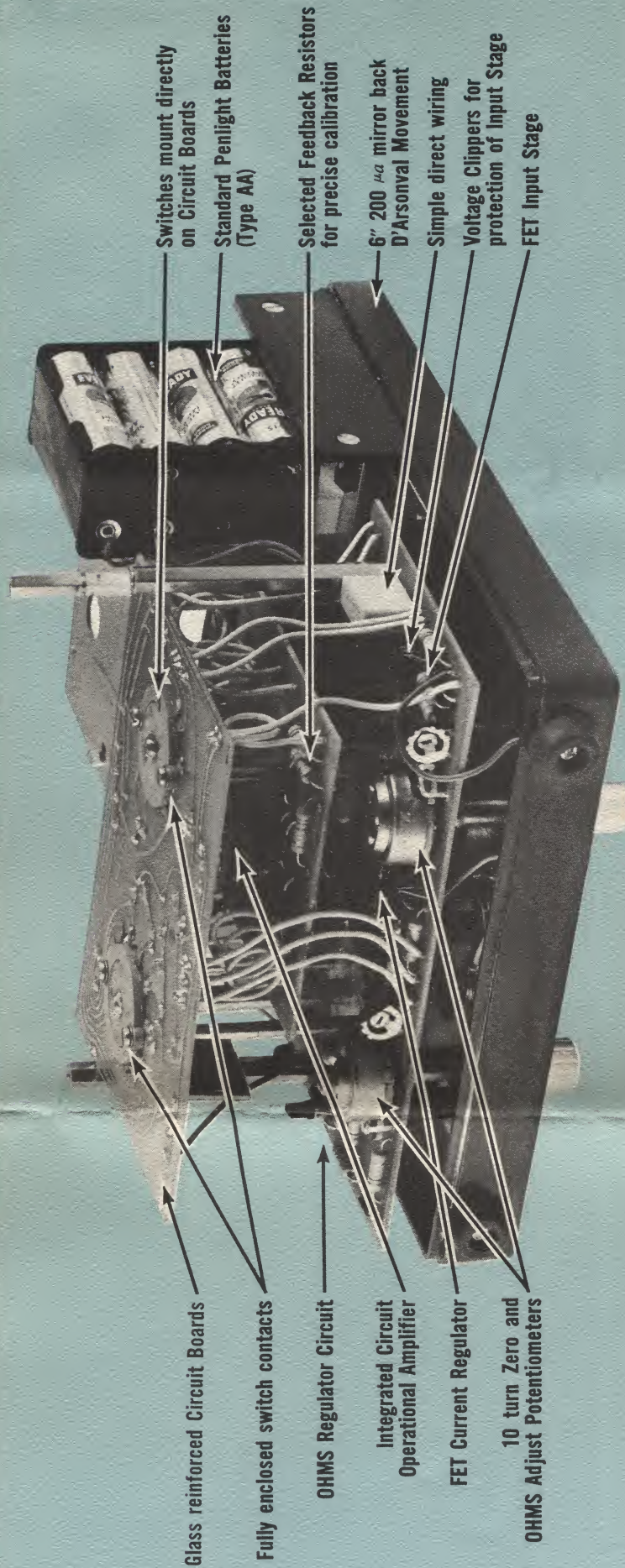
VOLTAGE: .3V, 1V, 3V, 10V, 30V, 100V, 300V, 1000V.
10 Megohms input impedance.



Order today from

DELTA PRODUCTS, INC.

P.O. BOX 1147 / GRAND JUNCTION, COLORADO 81501
AREA CODE: 303 PHONE: 242-9000



GENERAL INFORMATION

The Delta Model 3000 VOM is intended for use as high accuracy general purpose meter for laboratory and field maintenance of electronic and electrical equipment. The circuit design is such as to provide a meter which is virtually immune to electrical damage even with improper use. The active section of the instrument is designed around an integrated circuit operational amplifier, with the meter in the feedback loop of the operational amplifier. This system of operation provides excellent linearity on both AC and DC scales, and elimination of calibration drift caused by changes in the active elements. All components used in construction are the finest obtainable and include: high precision deposited carbon film resistors in all circuits, 10 turn potentiometers in the adjustment controls, and glass reinforced circuit boards for maximum strength and reliability.

The circuitry used in the Model 3000 is unique, and many of the circuits are newly developed for application in this instrument to avoid the problems exhibited in previous electronic instruments of this type. A brief description of some of the circuits follow:

OHMS CURRENT REGULATOR

The ohms current regulator has been incorporated to provide for maximum stability when switching scales, and for protection of semiconductor devices in circuit under test. The ohms regulator provides a maximum voltage of 0.3 of a volt and a maximum current of 30 milliamperes to the external test circuits and will not damage any reasonable power level semiconductor.

In the ohms regulator circuit a zener diode is employed as a prime reference element. The output of an adjustable voltage

divider placed across the zener diode is fed to a transistor operating as an emitter follower. This emitter follower output then supplies a reference voltage to another transistor, connected as a constant current regulator. Since a combination of NPN and PNP transistors is used, this forms a very highly temperature stable regulator system.

OPERATIONAL AMPLIFIER & METERING CIRCUIT

The operational amplifier (basically a high gain wide band DC amplifier) has an open loop gain of 1000 minimum and a closed loop gain of approximately two. The output current from this operational amplifier will represent the input voltage to an accuracy better than .2%.

One of the problems always associated with previous electronic type instruments as well as the standard multimeter are the non-linearity errors introduced on AC ranges by the associated rectifiers. In the Delta Model 3000, since the feedback loop of the operational amplifier is closed after rectification, all diode non-linearity and energy gap effects are completely eliminated. To correct from average reading AC to RMS, the feedback resistor is shunted to give an 11% higher reading (average equals .637 of peak. RMS equals .707 of peak. $\frac{.707}{.637} = 1.11$).

IMPEDANCE CONVERSION AMPLIFIER

The impedance conversion amplifier, which is unique in this instrument, changes a high impedance input signal into a low impedance signal without changing the voltage swing or zero reference level. An RC filter eliminates errors produced by stray pickup on DC ranges. This amplifier incorporates two

transistors operated as a low capacity double anode zener to protect the following circuitry against damage caused by over-voltage. The input field effect transistor is operated at a constant current level which is maintained by another field effect transistor to a value in which both transistors exhibit a near zero temperature coefficient. The input field effect transistor drives a feedback pair which provides a low output impedance with very low temperature sensitivity.

DIVIDER AND SWITCHING

In the Delta Model 3000 meter, a multiple use divider is employed to reduce the wiring complexity. On AC and DC scales, this divider represents a constant 10 megohm input impedance and gives minimal loading to any circuit. As the divider directly handles AC signals, some errors will occur at higher frequency due to distributed capacity in the resistor and switching circuits. To obtain maximum frequency response, the meter should be used in the 0.3 volts position with an external compensated attenuator as used on high frequency circuits. A standard detector for RF may be employed and a similar probe may be employed for wide band audio amplification if extreme accuracy is desired.

AMMETER RANGES

The DC ampere ranges operation of the Delta 3000 are also unique. The same divider used on AC and DC scales is connected as a shunt resistance whose value varies from 1 ohm on the 300 milliampere range to 10 megohms on the .03 microampere range. This allows for extremely wide current sensitivity and will allow the Model 3000 to be used in circuits in which normally an electrometer would be required.

EMPLOYEE DISCOUNTS

MARK TEN ASSEMBLED UNIT	\$27.95
MARK TEN DELTAKITS	24.95
COMPUTACH TACHOMETERS	24.95
FET-VOM ASSEMBLED	59.95
FET-VOM KIT FORM	49.95
HI-VOLT ANALYST ASSEMBLED	64.95
HI-VOLT ANALYST KIT	54.95
DELTALERT (Alarm System)	54.95

5% Sales Tax & 50c Handling Charge for Local Mail Orders

INTRODUCING



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